

## COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE//if not in response to a program announcement/solicitation enter NSF 15-1					FOR NSF USE ONLY	
NSF 15-581		09/22/15			NSF PROPOSAL NUMBER	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					[REDACTED]	
DUE - Strand 2: S-STEM; Design & Dev - Type 1 Single Ins						
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
09/14/2015	1	11040000 DUE	1536	943402412	11/01/2017 3:34pm S	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)		
856000545						
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF Awardee ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
Northern New Mexico College			Northern New Mexico College			
AWARDEE ORGANIZATION CODE (IF KNOWN)			921 Paseo de Onate			
0002378000			Espanola, NM. 875322649			
NAME OF PRIMARY PLACE OF PERF			ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE			
Northern New Mexico College			Northern New Mexico College			
			921 Paseo de Onate			
			Espanola, NM, 875322649, US.			
IS Awardee ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS		<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE
TITLE OF PROPOSED PROJECT <b>Biology and Environmental Science Training (BEST)</b>						
REQUESTED AMOUNT \$ 999,984		PROPOSED DURATION (1-60 MONTHS) 60 months		REQUESTED STARTING DATE 10/01/16		SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW <input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.G.2) <input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e) <input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d) <input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j) <input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____ PHS Animal Welfare Assurance Number _____ <input checked="" type="checkbox"/> FUNDING MECHANISM <b>EAGER</b>				<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____ Exemption Subsection _____ or IRB App. Date _____ <input type="checkbox"/> INTERNATIONAL ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j) _____ <input checked="" type="checkbox"/> COLLABORATIVE STATUS <b>Not a collaborative proposal</b>		
PI/PD DEPARTMENT <b>Biology</b>		PI/PD POSTAL ADDRESS <b>921 Paseo de Onate</b>				
PI/PD FAX NUMBER <b>505-747-5478</b>		<b>Espanola, NM 875322649</b> <b>United States</b>				
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address		
PI/PD NAME [REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]		
CO-PI/PD [REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]		
CO-PI/PD [REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]		
CO-PI/PD						
CO-PI/PD						

## CERTIFICATION PAGE

### Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

### Certification Regarding Conflict of Interest

The AOR is required to complete certifications stating that the organization has implemented and is enforcing a written policy on conflicts of interest (COI), consistent with the provisions of AAG Chapter IV.A.; that, to the best of his/her knowledge, all financial disclosures required by the conflict of interest policy were made; and that conflicts of interest, if any, were, or prior to the organization's expenditure of any funds under the award, will be, satisfactorily managed, reduced or eliminated in accordance with the organization's conflict of interest policy. Conflicts that cannot be satisfactorily managed, reduced or eliminated and research that proceeds without the imposition of conditions or restrictions when a conflict of interest exists, must be disclosed to NSF via use of the Notifications and Requests Module in FastLane.

### Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

### Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency?

Yes ☐

No ☒

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

### Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

### Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

### Certification Regarding Nondiscrimination

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

### Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
- (2) for other NSF grants when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

### Certification Regarding Responsible Conduct of Research (RCR)

**(This certification is not applicable to proposals for conferences, symposia, and workshops.)**

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

**CERTIFICATION PAGE - CONTINUED****Certification Regarding Organizational Support**

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

**Certification Regarding Federal Tax Obligations**

When the proposal exceeds \$5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations.

By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:

- (1) has filed all Federal tax returns required during the three years preceding this certification;
- (2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
- (3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

**Certification Regarding Unpaid Federal Tax Liability**

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

**Certification Regarding Criminal Convictions**

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME [REDACTED]		Electronic Signature	Sep 14 2015 11:34AM
TELEPHONE NUMBER [REDACTED]	EMAIL ADDRESS [REDACTED]		FAX NUMBER 505-747-2180

**NATIONAL SCIENCE FOUNDATION**  
**Division of Undergraduate Education**

**NSF FORM 1295: PROJECT DATA FORM**

The instructions and codes to be used in completing this form are provided in Appendix II.

1. **Program-track** to which the Proposal is submitted: Strand 2: S-STEM: Design & Dev - Type 1 Single Ins

2. Name of **Principal Investigator/Project Director** (as shown on the Cover Sheet):

[REDACTED]

3. Name of submitting **Institution** (as shown on Cover Sheet):

Northern New Mexico College

4. **Other Institutions** involved in the project's operation:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Project Data:**

A. Major Discipline Code: 61

B. Academic Focus Level of Project: BO

C. Highest Degree Code: B

D. Category Code: \_\_\_\_\_

E. Business/Industry Participation Code: NA

F. Audience Code: WMD S F \_ \_ \_ \_

G. Institution Code: PUBL

H. Strategic Area Code: EN

I. Project Features: 1 2 3 4 5

Estimated number in each of the following categories to be directly affected by the activities of the project during its operation:

J. Undergraduate Students: 25

K. Pre-college Students: 200

L. College Faculty: 15

M. Pre-college Teachers: 0

N. Graduate Students: 0

## PROJECT SUMMARY

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### Overview:

The Northern New Mexico College (Northern) Biology and Environmental Sciences Training (BEST) scholarship program will provide \$10,000 annual scholarships to 25 full-time, low income, academically talented underrepresented minority (URM) students with demonstrated financial need majoring in Biology or Environmental Sciences (ES). Goals include: 1) increasing recruitment (50%), retention (50%), degree progress (32% more credit hours/semester, 150% graduation time) and graduation rates (50%) of students pursuing Bachelor's degrees in Biology or ES, and support their entry into the local/regional/national STEM workforce or graduate programs; 2) implementing best practice supportive curricular (Peer-led Team Learning Study Groups, undergraduate research projects/summer research experiences, seminars, Faculty mentoring, conference participation), non-curricular (monthly cohort building extracurricular activities) and workforce development activities (paid summer internships) known to increase retention beyond two early attrition points, lead to graduation and entry into graduate programs or industry positions; and 3) implementing a longitudinal study that will contribute to understanding the effectiveness of supportive curricular, non-curricular and workforce development activities on retention, degree attainment and STEM career choices.

### Intellectual Merit :

The BEST program is important for the advancement of scientific knowledge and understanding of those practices and services that most effectively recruit, retain and graduate URM students in STEM. A review of the current literature reveals that many studies have looked at institutional data, but not student changes over time. Few studies have looked at self-identity with STEM as a career, especially among Native Americans. Students at Northern emerge from unique rural, ethnic, cultural, isolated, tightly knit communities, which may affect persistence. Their perceptions of STEM may be heavily impacted by their self-construal as interdependent rather than individualistic. Services that take this into account are key to retention and persistence, and any assessment of effectiveness should include these measures for URM populations. Given that a student's unique educational experience weighs more heavily in determining STEM persistence to degree completion than other factors, such as college-readiness, individual inadequacies, or socioeconomic status, combined with the push and pull effects of the community, a qualitative snapshot of student's perceptions would benefit Northern's attempt to shape such student experiences. Moreover, the current proposal will create a pipeline for URM STEM graduates entering graduate programs and STEM careers as a result of skills development. Students will be provided with a wide variety of state-of-the art technical training and professional development resources to support their academic success and entry into professional STEM career paths. In this regard, URM students are likely to contribute to new understandings in science/technology, advance knowledge, and add to the scientific literature.

### Broader Impacts :

Much information indicates that the future of the STEM workforce, and innovation itself, will be at risk without the contributions of all members of society, including URM and women. Almost three fourths of U.S. scientists and engineers are White. African Americans and Hispanics represent only 11% of all STEM employees, even though they comprise 26% of the workforce. The BEST program will address this lack of diversity and ensure that the U.S. continues to be a leader in science and technology. Broader impacts of the BEST project include learning what practices, support services and activities lead to strong STEM self-identity, thereby increasing the number of Hispanics, Native Americans and women with STEM degrees and research training. Through financial assistance, scholarship recipients can focus on their studies, complete a STEM degree, contribute economically to the region and to society through innovation and advancements in scientific knowledge. They will become researchers and teachers, inspiring future generations of URM students to also succeed in STEM.

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Project Summary (not to exceed 1 page)	1	_____
Table of Contents	1	_____
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) <b>(Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	15	_____
References Cited	2	_____
Biographical Sketches (Not to exceed 2 pages each)	6	_____
Budget (Plus up to 3 pages of budget justification)	10	_____
Current and Pending Support	3	_____
Facilities, Equipment and Other Resources	8	_____
Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	11	_____
Appendix (List below. ) <b>(Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	_____	_____
Appendix Items:		

\*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

### **Introduction to Northern New Mexico College (Northern)**

Northern meets the designation requirements for Native American- and Hispanic-serving. Northern's service area is made up of 18% Native Americans (versus 1.2% nationally) and 71% Hispanics (versus 17% nationally; US Census, 2014). The northern New Mexican Hispanics, however, are as culturally unique as the local Native American populations. They are unlike any other community designated "Hispanic" in the US, as they enjoy a 400-year insulated history in America after migrating from Spain, and have retained very specific linguistic and cultural characteristics more concretely identified as "Spanish" rather than Mexican or Latin American.

Although the region struggles with endemic poverty, a dearth of employment opportunities, rural marginality and a marked underrepresentation in baccalaureate degree attainment (16.4% compared to the national average of 28.8%; US Census, 2014), these distinct populations have amassed significant cultural, artistic and creative assets, that if properly developed and inspired, could contribute to enhancing the nation's STEM workforce and increasing completion rates among underrepresented populations. Northern's majority of first generation (53%) and underrepresented minority (URM) population (77%) contributes to a higher percentage of academically underprepared students (83% average), compared to the national average (60%), low retention rates (40%) from first to second year and second to third year (50%), and a significantly lower graduation average (17%) compared to the 2014 national average (55%) for first-time, full-time students seeking a Bachelor's degree at a 4-year institution and completing within six years (National Center for Education Statistics, 2015). This large gap in college readiness is due in large part to poorly performing public schools in the region (87% of K-12 regional schools failed to meet the 2011 NCLB AYP).

### **A. Results from Prior NSF Support**

#### **1) Results from Previous/Current S-STEM Awards:**

a) **0806469 DUE S-STEM: SCHLR SCI TECH ENG & MATH, Biological Sciences;** 08/01/2008 - 12/31/2013 (plus one-year no-cost extension); PI: [REDACTED] total award; \$10,000 per recipient/year; 28 scholarship recipients; 24 graduated; 86% graduation rate; 4 recipients left the program.

*Project Outcomes:* The Biological Sciences S-STEM Award 0806469 had a direct positive impact on recruitment, retention and graduation rates among biology majors at Northern. A more than 68% increase in enrollment was experienced over the five-year grant period. This increase directly correlates with the Biological Sciences S-STEM scholarship period, as the Environmental Science (ES) program, which had twice as many students in 2006-2007, grew consistently between 2008 and 2013, while Biology enrollment began to spike upward as the scholarships began drawing students (Figure 1). In addition, the Biological Sciences S-STEM Award was successful in graduating larger cohorts of students: 86% over seven years - double the rate when compared to a 41% graduation rate among all students at Northern in the same time frame. Of the 24 graduates, 50% graduated Magna Cum Laude (17%) or Cum Laude (33%), 96% were underrepresented ethnic minorities, and 71% were women. *Relationship of this Proposed Project to Other S-STEM and STEP Awards:* The College of Engineering and Technology was awarded an S-STEM grant in 2013. The PI of that award, Dean Ivan Lopez, is a member of the Steering Committee, has provided guidance on several elements of this proposal, and will continue to support its success through advice and lessons learned from his S-STEM grant. Dr. Lopez was also the PI of a previous STEP award to Northern, and highly encouraged seminars that proved with his grant to be of great interest to STEP participants. *Lessons Learned*

*from Project Activities and Outcomes:* It is clear that merit- and need-based scholarships are an essential component to the overall intellectual growth and enrichment of STEM students at Northern. Introducing students to undergraduate research and other scientists and industry experts through seminars and summer research internships was key to the overwhelming success that was experienced. Providing up to \$10,000/year proved effective, as Northern's students are very high need (\$20,000 per capita income in the region). Students are either going to work to support themselves and their families, and go to school part-time, or they will need maximum scholarship support in order to attend full time and complete their degree. *How Lessons Learned Influenced this Project:* The current proposal is *requiring* scholarship recipients to enroll in a seminar, undergraduate research and research-based capstone course, and to have weekly interactions with a faculty mentor. Recipients will also be *highly encouraged* to participate weekly in a Peer-led Team Learning (PLTL) study group. Childcare stipends will support parents in greater participation. A longitudinal study will help determine the effectiveness of each of these and other interventions.

**b) 1259993 DUE S-STEM: SCHLR SCI TECH ENG & MATH, Engineering; 08/01/2013 - 12/31/2018; PI: [REDACTED]; \$621,708 total award; \$2,500 and \$5,000 scholarships; 47 one-semester scholarships have been awarded over four semesters; three students have graduated in the 2-years of the award; 1 scholarship recipient thus far left to attend a larger institution.**

*Project Outcomes:* Data for three semesters indicate that scholarships have helped the engineering programs with retention. Of the 22 recipients that received scholarships in the first three semesters, only one student left the program. Three scholarship recipients have graduated and began working in their field before graduating. Also, students began taking an average of 1.5 credit hours more per semester after receiving scholarships; and 32% of scholarship recipients have engaged in research experiences and workforce related internships. *Relationship of this Proposed Project to Other S-STEM and STEP awards:* The Engineering S-STEM grant, the STEP award and previous Biological Sciences S-STEM grant all focus(ed) on recruitment and retention, provide(d) first year students with hands-on approaches to learning, and offer(ed) tutoring services. In all cases, enrollment and retention were greatly increased. *Lessons Learned from Project Activities and Outcomes:* Community-building among faculty and students has been critical in the success of this Engineering S-STEM program. The gathering of students and faculty together for meetings, to engage in outreach activities, for seminars and other extracurricular activities has created a strong cohort and increased retention. Also, summer internships have been important for recent graduates in finding employment upon graduation.

## **2) Results from Prior STEP Awards:**

**0757088 DUE STEP: STEM TALENT EXPANSION PROGRAM; 06/15/2008 - 05/31/2013 (plus one-year no-cost extension); P.I.: [REDACTED] \$499,065 total award; more than 300 students participated in project activities; activities included Dual Credit with local high schools, a summer math enrichment program, an engineering First Year Experience course, tutoring in a variety of STEM fields, and STEM seminars with invited scholars; retention was originally 50% for first year students, and increased to 76% among STEP participants; 8% graduated with a degree in targeted STEM programs within five years.**

*Project Outcomes:* The STEP grant focused on recruitment and retention. Successful initiatives have been institutionalized, including Dual Credit with local high schools and the "Math Accelerator Program," a summer math enrichment program taught in the Engineering Department. Tutoring in a variety of STEM fields and STEM seminars with invited scholars also



addressed many of the broader academic challenges that students face. Results from this STEP program indicate that students who complete the first year are 87% more likely to graduate. *Relationship of this Proposed Project to Other S-STEM and STEP awards:* The current proposal will also seek to recruit college freshmen and sophomores with undeclared majors to Biology and ES, will encourage research during the academic year, sponsor summer internships, provide seminars that expose students to scientist and practitioners, will offer regular field trips and other cohort building activities, and will provide support services including peer-led study groups, faculty mentoring, and tutoring for students at risk in STEM courses. *Lessons Learned:* If students persist beyond two critical attrition points, they are 87% more likely to graduate. Engaging in research in the formative college years, engaging faculty mentors, professional seminars and cohort building activities enhances learning and retention. *How Lessons Learned Influenced this Project:* This project will provide many of the same support systems and undergraduate research opportunities.

### **3) Results from Other Relevant NSF Awards:**

**1035465 DUE ROBERT NOYCE SCHOLARSHIP PROGRAM;** 10/01/10 - 09/30/15 (plus one-year no-cost extension); PI: [REDACTED], \$1,152,055 total award; \$12,000 per recipient/year; 18 scholarship recipients to date; 9 have graduated to date; 50% graduation rate to date; 1 recipient has left the program to date.

*Project Outcomes:* The Noyce Scholarship Program is designed to recruit, prepare and induct undergraduate STEM majors into the secondary science teaching profession. To date, 18 students have been recruited into the program: 4 undergraduates and 14 STEM graduates. Twelve have become teachers. A survey administered by the external evaluator showed that recipients have found the seminars to be helpful. *Relationship to Other S-STEM Awards:* Substantial financial assistance helps students focus on their education. STEM teaching is one possible career path for Biology and ES majors. *Lessons Learned:* Recruitment efforts have been challenging to this program. Providing \$12,000 annual stipends has greatly contributed to student retention and graduation. *Influence of Lessons Learned:* Recruitment of scholarship recipients will require maximum effort; seminars are important; becoming a teacher is a career option.

## **B. Project Goals and Objectives**

The BEST program goals and objectives are summarized in Table 1.

Table 1. BEST Goals and Objectives

<b>Goals</b>	<b>Objectives</b>
1. Increase the recruitment, retention, student success, and graduation rates of low-income academically talented students with demonstrated financial need who are pursuing baccalaureate degrees in Biology or Environmental Science, and support their entry into the local/regional/national STEM workforce or graduate study.	1) Provide \$10,000 annual scholarships to enable 25 recipients to focus on their education full-time and prepare for a STEM career and/or graduate program. 2) Increase the number of full-time Biology BS majors by 50%: from 36 (current) to 54 by 2021; and the number of full-time Environmental Science BS majors from 44 (current) to 66 by 2021. 3) Increase retention rate by 50% from year one to two (40% to 60%); and from year two to three (50% to 75%) by 2021. 4) Decrease time to graduation by requiring a minimum of 12 credit hrs/semester (a 32% increase from current 9.1 credit hr/semester average). 5) Increase by 50% the percentage of students who graduate with a BS degree within 150% time (17% to 26% by 2021). 6) Maintain the collective average GPA of all recipients at 3.0 or above.

Goals	Objectives
2. Implement best practice supportive curricular, non-curricular and workforce development activities known to increase STEM retention beyond two early attrition points, lead to graduation and entry into the workforce or grad school by academically talented STEM majors with demonstrated financial need.	1) 90% of all recipients will participate regularly in a PLTL study group. 2) 50% of parents will utilize daycare stipends to be able to take part in PLTL study groups and engage in at least one extracurricular activity per semester. 3) At least 75% of recipients will engage in research activities during the academic year. 4) At least 75% of scholarship recipients will engage in at least one summer workforce or research internship. 5) At least 5 recipients in year one and 10 in years two to four will participate in a local or regional conference; and two per year will travel to a national meeting/conference. 6) 75% of recipients will participate in monthly extracurricular activities.
3. Implement a longitudinal study that will contribute to understanding the effectiveness of supportive curricular, non-curricular and workforce development activities on URM student recruitment, retention, academic/career pathways, and degree attainment among low-income and academically talented Biology/ Environmental Science majors.	1) Perform a longitudinal study of scholarship recipients that will assess the general risk of students leaving a STEM major (Chen and Ho, 2012; Chen and Soldner, 2013). 2) Analyze math anxiety among STEM and non-STEM majors (Chen, 2009). 3) Develop and analyze student services and other factors that correlate with increases in STEM identity for students declaring a STEM major. 4) Analyze the effectiveness of PLTL study groups. 5) Analyze the effectiveness of research during the academic year as a positive influence for developing a STEM self-identity. 6) Analyze summer research and workforce internships on the development of a positive STEM self-identity and on graduate school/workforce success. 7) Generate a 'Risk of Leaving' STEM scale that can be used at critical points to intervene with proven student support services.

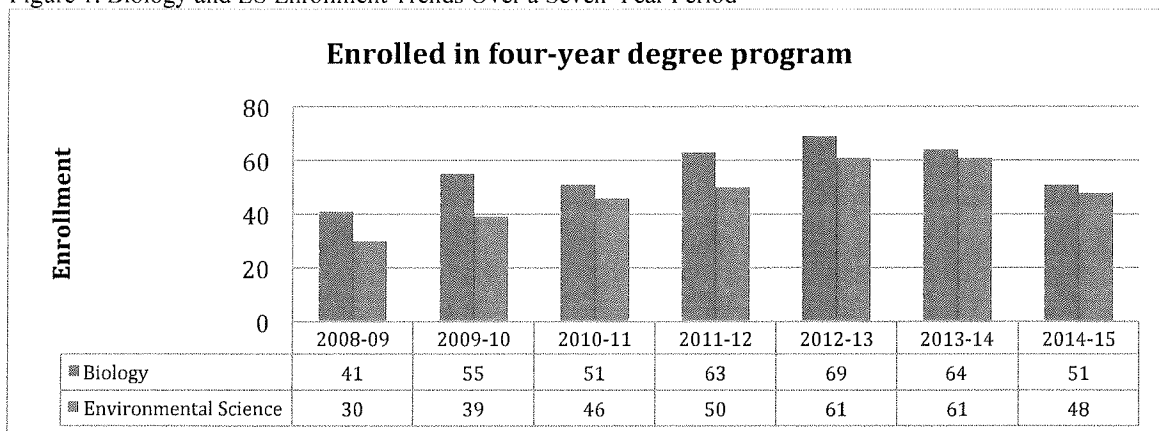
Specific plans for the selection of scholarship recipients are delineated in section F. Through the activities and student services designed to meet the objectives, scholarship recipients will be encouraged and supported to achieve their best academic performance, persist beyond identified attrition points, complete their STEM degree, and be more highly qualified and competitive when entering the STEM workforce or graduate programs.

### C. Significance of Project and Rationale

Student enrollment in the Biology four-year degree program steadily increased by 68% during the five-year period of a previous Biological Sciences S-STEM grant (2008-2013), as can be seen (blue bars) in Figure 1. The number of Biology majors has since fallen by 48% (69 in Spring 2013 and 36 in Fall 2015). This drastic decrease is attributed to the graduation of 24 previous S-STEM scholarship recipients by 2015, combined with attrition and falling enrollment.

Comparably, the ES four-year degree program has shadowed the Biology program (red bars) for the same time period, as can be seen in Figure 1. After experiencing a 103% increase in enrollment between 2008 and 2013, enrollment in ES has dropped by 28% (61 in Spring 2013 and 44 in Fall 2015). While Northern is the most affordable four-year degree-granting institution in the state, over the past five years tuition has increased by 69%. These necessary increases realigned the cost of attendance with the actual cost of its operations as a four-year degree granting institution, but have caused a steady decline in Northern's overall student enrollment (36.5% in the past three years) and has negatively impacted Biology and ES program enrollment.

Figure 1. Biology and ES Enrollment Trends Over a Seven-Year Period



In addition to enrollment declines over the past few years, retention data over a decade indicates two critical attrition points: 1) first to second year retention, which is 40% (fall to fall); and 2) second to third year retention, which has held steadily at 50%. For those students who persist into their junior and senior years, new challenges emerge, including applying their coursework to real-life situations, and being competitive in the job market compared to graduates from significantly larger New Mexico-based research institutions, such as the University of New Mexico and New Mexico State University. Moreover, the convergence of myriad cognitive, non-cognitive and socio-economic challenges that Northern's students face has contributed to low degree attainment. The four-year graduation rate is 10%. This increases to 17% over six years, and to 41% over a seven-year period. Despite these stark statistics for the college overall, the Biology department actually increased its enrollment by 68% and graduated 86% of scholarship recipients from the previous Biological Sciences S-STEM award over a seven year period.

The mentor/student relationship has been shown to be essential in the development of a successful STEM student and ensuring their success when they enter the STEM workforce or STEM graduate programs. Carlone and Johnson (2007), in a landmark study on minority retention in STEM, found that a student self-identifying with '*being a science person*,' and being *recognized* as such by their faculty role models, created a sense of belief in their own abilities to succeed in the sciences, and thus enhanced their chances of persisting. Chang et al. (2010) found that an entering students' *academic self-concept* significantly predicted the likelihood of their persistence, more than their actual level of college-readiness. These findings again suggest that it is not high performing students that necessarily persist and succeed. Chang, et al. (2010) also found that undergraduate research, participation in an academic club or organization, and studying frequently with others all increased the likelihood of underrepresented minority persistence, and working during college significantly reduced the chances of degree completion.

Owens in her study, "Neighborhoods and Schools as Competing and Reinforcing Contexts for Educational Attainment" (2010) reported that a student's community can interject a sense of 'push and/or pull,' providing a competitive and/or supportive aspect which may contribute to the student's academic success or failure. Seymour and Hewitt (1997) concluded that a student's unique educational experience weighed more heavily in determining STEM persistence to degree completion than other factors such as college-readiness, individual inadequacies, or socioeconomic status.

This suggests that while colleges can do little about student's lack of academic preparation, they can shape STEM student *experiences* and foster a *sense of belonging* to improve student success. These findings also suggest that exploring student's perceptions of their college experiences, their levels of math anxiety, and reasons for not attending classes (a major problem at Northern), might predict STEM persistence. 'Push and pull' factors among Northern's students are known to impact retention, persistence and attendance. Anecdotal evidence from Northern STEM faculty and students suggest that: 1) a *sense of belonging* is key to retention at Northern, given students' strong interdependent self-construals with their communities/families; and 2) that such integration with community/family may impact Northern's Hispanic and Native American students much more so than is experienced with other students from mainstream culture. Therefore, the single most critical challenge facing Northern is to create an environment that fosters a supportive college experience so that students from unique and diverse backgrounds can meet with success in their educational goals.

The BEST program has been designed to address many of the fundamental needs, challenges and barriers to success that students in the region face, and to support them in overcoming them. The BEST program proposes to provide support to 25 academically talented, underrepresented ethnic minority Biology and Environmental Science majors with demonstrated financial need who may not otherwise attend full time and who would be at risk of not graduating, with \$10,000 in annual scholarships so they can focus on their academic program, enroll full time and graduate within 150% time or less.

All scholarship recipients will be required to meet weekly with a faculty mentor so they can begin to develop of *sense of belonging* and identification with being a *science person*. The best-practice student support model, Peer-Led Team Learning (PLTL), a nationally recognized model of teaching and learning developed for a Chemistry class at the City College of New York, will be implemented to provide structured peer learning study groups, and will be highly recommended to all participants. A substantial body of research has demonstrated improvements in student learning and positive impacts on student success and retention in STEM with PLTL (Arendale, 2004). Two high achieving upper division Biology and ES students and two upper division Psychology majors will be selected and trained as *peer-leaders* - students who facilitate small-group learning. Two peer-leader teams, consisting of one STEM and one Psychology peer leader, will be formed, and each week they will meet with their respective group to engage in peer facilitated group discussions and problem solving.

Students will also be highly encouraged to engage in undergraduate research projects during the academic year; take part in at least one summer research or industry internship; travel to local, regional and national conferences; participate in monthly extracurricular cohort-building activities; and participate in an academic club or organization. Stipends for childcare will be provided for scholarship recipients who are parents in need of support in order to attend and participate in these important activities.

Through a longitudinal study, the PI and Co-PI's will examine if and how these support services and cohort building activities foster persistence beyond identified attrition points, lead to degree completion, and ensure success in entering rewarding STEM careers and/or graduate programs. The longitudinal study will also yield a 'Risk of STEM Leaving' tool that will be used to identify students most at risk for leaving STEM programs. A longitudinal cohort tracking design will be used to research and assess a number of highly significant questions that will help Northern to better understand what services and under what circumstances students succeed or fail in STEM programs. Table 2 summarizes this information.

Table 2. BEST Social Science Research Design and Questions

Research Design	Research Questions
<p>1) Examine STEM ‘entrant’ attitudes regarding Math (anxiety) during first semester. Math anxiety will be measured in all math classes (a census sample) to create a comparison group.</p> <p>2) Identify scholarship recipients who are at “Risk of Leaving STEM.”</p> <p>3) Determine if participating in a PLTL study group ameliorates attrition from Year 1 to Year 2, and from Year 2 to Year 3. Student’s experiences of PLTL will be measured by focus group and satisfaction measures/surveys.</p> <p>4) Determine if summer research/ workforce internships in STEM fields increases sense of belonging in STEM and self-identifying with being a science person, and ameliorates attrition from Year 1 to Year 2, and from Year 2 to Year 3.</p> <p>4) Determine if student’s perceptions of STEM change over time as a result of faculty mentoring and cohort building/professional activities.</p> <p>5) Assess graduation rates by tracking alumni and measuring whether intervention activities influenced their success in STEM.</p>	<ul style="list-style-type: none"> <li>• What recruitment strategies increase STEM enrollment?</li> <li>• Do perceptions differ for STEM and Non-STEM majors?</li> <li>• For what reasons do students select STEM as a major?</li> <li>• Why do students change from STEM to non-STEM?</li> <li>• What predictors determine ‘risk of leaving’ STEM?</li> <li>• Do STEM ‘leavers’ and ‘persisters’ differ in how many Math courses they have taken, their performance in them, and their levels of Math anxiety?</li> <li>• Does sense of belonging differ in those who leave STEM?</li> <li>• Do Native American and Hispanic students differ from other students in terms of interdependent self-construal?</li> <li>• Do students with low class attendance differ from those with high attendance? What are reasons for non-attendance? Do the reasons involve push-and-pull factors?</li> <li>• Do those who remain in STEM participate more in PLTL?</li> <li>• Do STEM ‘leavers’ and ‘persisters’ differ in participation in professional-development and cohort-building activities?</li> <li>• Do STEM ‘leavers’ and ‘persisters’ differ in their satisfaction with gains in skills from lab experiences?</li> <li>• Do STEM ‘leavers’ and ‘persisters’ differ in satisfaction with research/workforce internship experiences?</li> </ul>

#### D. Activities on Which the Current Project Builds

The BEST Scholarship Program proposal has been developed with experience gained from administering the NSF Biological Sciences S-STEM Project 0806469, from results generated from three other NSF scholarship-based grants, and from a Title III US Department of Education STEM grant, which provides funding for collaboration between Northern, Santa Fe Community College, UNM-Taos, and UNM-Los Alamos. Grant initiatives simplify, and make collaborative, outreach efforts to middle and high schools. They also support a shorter degree completion time by developing and sharing online courses and by creating STEM course transfer and articulation agreements among all STEM 2-year degrees and Northern’s 4-year degrees.

The BEST program also builds on several current program requirements for Biology and ES students, including a one-credit hour seminar series, a one-credit hour undergraduate research experience lab, and the senior-level research-based capstone course. In addition, students must meet at least four times per year with their faculty academic advisor to ensure they remain on their chosen academic track. Many students are also engaging in undergraduate research experiences with all Biology, Chemistry, ES and Mathematics faculty through other sources of funding. By combining each of these existing activities with new student services and programs, such as required weekly meetings with Faculty Mentors, highly recommended studying with PLTL study groups, participating in summer internships, traveling to professional meetings, and engaging other scholarship recipients in extracurricular activities and clubs, the BEST program will build upon what these programs, and expand opportunities to a larger number of students.

#### E. S-STEM Project Management Plan

A Steering Committee has already been created to support the development of this BEST

Scholarship Program proposal. The Committee consists of [REDACTED], who serves as PI for this project, Chair of the Steering Committee and will have overall responsibility for administering the project and for interacting with NSF; [REDACTED], Assistant Professor of Psychology, who serves as Co-PI and will execute the longitudinal study for this project; [REDACTED], Director of Academic Advising and First Year Experience, who serves as Co-PI and will oversee the student support services implemented with this project, as well as train and oversee the Peer Mentors; [REDACTED], Director of Financial Aid; [REDACTED], Dean of the College of Engineering and PI of the current DUE S-STEM Engineering grant (1259993) and Co-PI of the prior DUE STEP grant (0757088); [REDACTED], Director of Mathematics and PI of the Robert Noyce Scholarship Grant; and six other faculty from the Department of Biology, Chemistry, Environmental Science, and Mathematics who will serve as Mentors and Research Advisors: [REDACTED], [REDACTED], [REDACTED], [REDACTED], [REDACTED], [REDACTED].

[REDACTED]. This group of individuals has already met in different configurations during the development of the BEST proposal to generate the presented scholarship allocation plan, the student support services plan and the faculty and peer mentoring plan. Having [REDACTED] and [REDACTED] on the Steering committee of the BEST program has and will continue to encourage and support stronger collaboration between NSF S-STEM PI's and other scholarship-based programs at Northern, foster greater information sharing, and create opportunities to learn together during formative and summative stages of their programs.

The Steering Committee will work collectively to recruit scholarship applicants during the Fall 2016 and Fall 2019 (seniors), and will meet together at the end of those semesters to evaluate and select scholarship recipients from submitted applications. They will then meet again at the beginning of each subsequent semester thereafter to determine the success of recipients and to re-qualify them for additional semesters. They will also meet collectively as needed to replace unsuccessful recipients who leave the program or become disqualified. In addition, different members of the Committee will meet in various 'subcommittees,' including:

- The Chair will meet with Faculty Mentors every two weeks for the first half of each semester, as dropout rates are very high through mid term, making the first 8 weeks critical in ensuring student retention and success.
- The Chair will meet with the two other Co-PI's monthly to discuss the student support services and the longitudinal study being implemented.
- The Chair will meet with the Director of Advising and first year Academic Advisors, as well as Faculty Advisors who advise students after their first year, at the beginning of each semester to ensure that adequate degree progress is being made.
- The PI will interact with NSF on all reporting and will: organize Steering Committee meetings; oversee Advising faculty-scholarship recipient progress; oversee Research and Faculty Mentor-scholarship recipient relationships; organize the various student events, activities and programs; and interact with all scholarship recipients regularly, providing mentorship, encouragement and support in the development of a strong self-identity.
- The Chair will support the Social Science Research Co-PI regarding her research, in maintaining a secure database of recipient information, and in collecting and storing data.

#### **F. Student Recruitment, Selection Criteria and Selection Process**

*Recruitment of Scholarship Applicants:* If this project is funded, Steering Committee Members and recruitment staff at Northern will organize recruitment activities for high school

seniors at Espanola Valley High, Peñasco High and Capital High in Spring 2016. Significant STEM outreach is already in place at these schools. Steering Committee Members will also recruit Freshman applicants from students participating in three summer bridge programs at Northern during Summer 2016 and from among first-semester undeclared freshman enrolled in First Year Experience, Biology, ES and Math courses during the Fall 2016. Sophomores, Juniors and Seniors will be recruited from among all currently enrolled students. Social media campaigns, posters and flyers in STEM classrooms, labs and throughout the campus, website postings, and email notifications to all students will present scholarship opportunities and direct students to the Northern website where application forms, instructions and success stories from former Biological Sciences S-STEM awardees will be posted. A second round of recruitment for senior-level students will take place in Spring and Summer 2019, as per Table 3.

*Eligibility Criteria:* Eligibility for scholarships will be based on an applicant's citizenship, major, academic potential, academic progress, and demonstrated financial need. All recipients will meet the following eligibility criteria on a per semester basis:

- Be a United States citizen, permanent resident, national or refugee.
- Declare a baccalaureate major in Biology or Environmental Sciences.
- Maintain a minimum 2.5 GPA and show progress towards degree attainment.
- Enroll as a full-time student with a minimum of 12-credit hours/semester.
- Complete a FASFA application through the financial aid office.
- Maintain demonstrated financial need throughout the duration of the BEST Program.

Eligibility of all applicants will be determined by: 1) the fact that only US citizens, permanent residents, nationals and refugees can apply for and receive Federal financial aid; 2) FASFA forms provided by the Director of Financial Aid, a member of the Steering Committee and selection process, will demonstrate need; and 3) transcripts or other GPA, declared major and enrolled hours/semester documentation provided by the Director of Advising, a Co-PI, or found in the Banner database. As noted above, the Steering Committee will meet at the beginning of each semester to review updated documents and to determine if current recipients remain eligible. The Office of Financial Aid will distribute all scholarships directly to recipients.

*Scholarship Recipient Selection Process:* Students will be selected by the Steering Committee according to their course-level status and according to the schedule noted in Table 3.

Table 3. Scholarship Recipient Selection Timetable

Total Number of Students Per Academic Status	Year 1 Spring	Year 2	Year 3	Year 4	Year 5 Fall
10 Freshman Tracked and Compared for 5 years	10	10	10	10	10
5 Sophomores Tracked and Compared for 3 years	5	5	5		
5 Juniors Tracked and Compared for 2 years	5	5			
5 Seniors Tracked and Compared for 1 year				5	

They will be selected based on their financial need, as per their FASFA forms, and their academic merit, based on their GPA and 12 credit hour enrollment minimum. Freshman, Sophomore and Junior applications will be reviewed by the Steering Committee at the end of the Fall 2016 semester, and senior applicants at the end of Summer 2019, and all documentation noted above will be reviewed at the beginning of each semester thereafter to determine continued eligibility. Applicants will be given points based on a scale determined by the Steering

Committee for each of the eligibility criteria listed above. The amount of Federal Financial Aid a student receives will be deducted from a \$21,000 Cost of Attendance at Northern. The higher the difference, the higher the number of points an applicant will receive. For merit, applicants will receive more points for a higher GPA. In addition, other factors, including volunteer activities, honors and awards, athletic and academic abilities, and other important personal factors determined by the Steering Committee, will also be taken into account. Applicants with the highest overall points will be selected as scholarship recipients.

In the event a student leaves the program, recruitment will begin immediately for applicants who meet the course-level status (Freshman, Sophomore, etc.) of the individual who left, and replacements will be selected in the exact manner described above for original recipients. One month will be provided for students to submit applications, after which the Steering Committee will meet to review and select the replacement. The 25 scholarship recipients will be selected in a staggered manner to allow for a larger number of students being provided scholarships and support services; and to ensure small faculty mentor-to-student ratios throughout the five-year program. All recipients will have at least one summer in the program to take advantage of summer research or industry internships.

*Longitudinal Cohort Tracking:* The social science research will include extensive interviews with about 250 students enrolled in all math classes at the beginning of the project and will study over the five year period a number of variables related to early attrition points, graduation and ability to succeed in the workforce/graduate school. The cohorts listed in Table 3 will be tracked, measured and compared to themselves and to a non-STEM comparison group over time. The Sophomore, Junior and Senior cohorts will provide helpful information regarding those factors that support graduation and entering successful STEM careers/graduate programs. The Freshman and Sophomore cohorts will provide vital information on those factors involved in overcoming identified early attrition points (Year 1 to 2; Year 2 to 3). Tracking cohorts and monitoring changes in their perceptions over time provides an advantage when determining what aspects of the program support retention and degree completion.

## G. S-STEM Student Support Services and Programs

The BEST program has identified best practices, including undergraduate research experiences, faculty mentoring, PLTL study groups, summer research and industry internships, travel to professional conferences, science seminars with invited speakers from industry and research, extracurricular cohort building activities, career counseling, and student organization participation, that will be required or highly recommended to promote a sense of self-identity as a STEM person, create a positive college experience, and promote academic development among scholarship recipients. Required and highly recommended activities are noted in Table 4.

Table 4. Required and Highly Recommended Activities for Scholarship Recipients

Required Activities	Highly Recommended Activities
Meet with faculty mentor or research mentor once/week	Engage in research with a STEM faculty
Enrollment in a minimum of one 3-credit Undergraduate Research Experience (URE) course in Biology, Chemistry, ES or other STEM discipline	Join PLTL Study Group at least once weekly
Enrollment and attendance in a monthly Visiting Scholars	Apply for participation in a URE summer research or paid industry internship



Required Activities	Highly Recommended Activities
<p>Seminar Series</p> <p>Meet with academic advisor at least 4 times/semester: at beginning and end of semester, within first two weeks and after mid-terms</p> <p>Maintain active membership in at least one STEM student organization, such as the Biology Club, the institutional chapter of SACNAS, the Physics Club, etc.</p>	<p>Travel to local, regional and national research conferences; present research results</p> <p>Participate in one extracurricular activity with cohort monthly</p> <p>Engage in career counseling as provided by:</p> <ul style="list-style-type: none"> <li>· research mentors</li> <li>· visiting research scholars</li> <li>· campus career services counselors</li> </ul>

It is important to note that while some activities are listed as ‘recommended’, the mandatory student/faculty mentor interactions will drive and promote interactive involvement in all elements of their programs of study, with their classroom and research faculty, and with their own research projects in order to promote their own growth and academic success.

## H. Quality of Educational Program

Northern gained accreditation by the Higher Learning Commission (HLC) of the North Central Association of Colleges and Schools in 1982, is governed by a six-member board of regents appointed by the governor of New Mexico, and has oversight from the New Mexico Higher Education Department. Northern is also an Academic Quality Improvement Program (AQIP) institution since 2001, with an extensive network of Process Improvement Teams. In late fall 2014 and continuing through summer 2015, Northern administrators, faculty, and staff began reviewing the nine AQIP pathway categories that provide a framework for examining Northern’s key processes and to inform the assessment and accreditation responses to the HLC comments to Northern’s Systems Portfolio. This process has been invaluable for all members of the institution in terms of contributing to the analysis, identification, and exploration of opportunities for institution-wide improvement.

Northern’s Department of Biology, Chemistry and Environmental Sciences was established in 2008. Bachelor’s and associate’s degrees are offered in Biology and Environmental Science, and an associate’s degree in Chemistry. Northern also offers bachelor’s and associate’s degrees in Mathematics and Physical Sciences, and in Information Engineering Technology and Mechanical Engineering. Northern’s rapid STEM-related growth in the past few years has attracted grant funding and recognition from industry and higher education communities, including by the Advancement of Chicanos and Native American Scientist (SACNAS) for its Biology and Environmental Science programs. With modern science research laboratories for the study of neurobiology, molecular and cell biology, physiology and behavior, ecology and evolution, chemistry, biochemistry, microbiology, tissue culture, environmental monitoring, natural resources, and parallel supercomputing, stimulating hands-on learning environments that include myriad undergraduate research opportunities are provided to all interested students.

Students who major in Biology, Chemistry or Environmental Science have a one-semester undergraduate research course requirement as part of their degree program, in addition to a capstone course in their senior year in which they also engage in research and present their findings during an annual Science Symposium. These students are also required to enroll in a one-semester seminar course as part of the degree programs. These required undergraduate

research and seminar experiences are critical to providing students exposure to scientific methodology and the research process, as well as to scientists from other institutions who share additional insights and research ideas that further inspire and support student development as aspiring scientists. These courses, as noted, are required for all students in these programs.

Northern serves as a teaching college, but many of its doctorate-level STEM faculty are recipients of a variety of national, regional and state grants that facilitate and support undergraduate research training for interested students. Northern STEM faculty also serve as Co-PI's and Collaborators on grant programs that support intensive summer research experiences at large research institutions in a wide array of fields from which scholarship recipients can choose. Collaborations with industry will also provide workforce development training for scholarship recipients, who will be highly encouraged to participate in at least one summer internship. The Facilities, Equipment and Other Resources document lists Northern STEM faculty and their areas of research in which S-STEM scholars will be highly encouraged to participate during the academic year, and lists the research institutional and industry collaborations providing summer internships. Letters of collaboration from many of these institutions are also included.

## I. Assessment and Evaluation

*Social Science Research and Assessments:* The research will assess whether the support services and activities impacted retention/graduation using a longitudinal cohort design. The measures employed are derived from the NSF *Common Guidelines for Education Research and Development* and involve qualitative and quantitative components. Table 5 outlines the goals and measures planned to implement the longitudinal study of Northern's unique student population.

Table 5. Goals and Measures Planned to Implement Longitudinal Study

BEST PROJECT GOALS	BEST MEASURES
Define cohorts for longitudinal design, track students, and re-measure at points during 2016-2021	We will use the definition of <b>STEM entrance</b> (National Science Foundation: <a href="http://www.nsf.gov/statistics/1316">http://www.nsf.gov/statistics/1316</a> ..
To form a comparison group	<b>Non-STEM</b> majors are students at Northern who will form a comparison group, that have never declared a STEM major.
To track graduation	<b>STEM persisters</b> are the subgroup of STEM entrants who remain in STEM fields throughout their college career.
To track attrition	<b>STEM leavers</b> are the subgroup of STEM entrants who leave STEM fields either by switching their major to a non-STEM field or by leaving postsecondary education.
To identify STEM attitudes and what student services affect changes in those attitudes	Colorado Learning Attitudes about Science Survey (CLASS) (Semsar <i>et al.</i> , 2011).
To increase STEM entrants	Qualitative interviews of women as STEM entrants to the cohort
To identify low attendance students	Singelis' Self-Construal (1994) and qualitative interviews.
To measure Math Anxiety	Math Anxiety Scale: Math Anxiety Self-Tests (Freedman, 2006; Suinn and Winston, 2003).

BEST PROJECT GOALS	BEST MEASURES
To assess success of Peer-led Team Learning Study Groups	Focus groups to determine satisfaction with groups; also administer Pintrich, R. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance.
To assess success of Summer Internships	Student Course Engagement Questionnaire (Handelsman, 2005).
To assess success of Professional Activities	Seymour's (2003) statements that measure student perceptions.

Table 6 provides the timescale on which each activity of the longitudinal study will take place. Early attrition points are heavily targeted in the first four semesters to gain comparative samples and establish baselines. Tracking will occur at key points to collect additional measures to establish individual changes over time. Analyses will determine the effect of faculty and peer mentoring, summer internships, and engagement in professional activities as triggers for STEM leaving or enhanced STEM *self-identification*.

Table 6. Timescale for BEST Research Project

Work Step	Semester														
	<i>Early Attrition Points</i>			<i>Tracking and Repeated Measures Testing</i>									<i>Data Analysis</i>		
	<i>F</i> <i>'16</i>	<i>Sp</i> <i>'16</i>	<i>Sum</i> <i>'16</i>	<i>F</i> <i>'17</i>	<i>Sp</i> <i>'17</i>	<i>Sum</i> <i>'17</i>	<i>F</i> <i>'18</i>	<i>Sp</i> <i>'18</i>	<i>Sum</i> <i>'18</i>	<i>F</i> <i>'19</i>	<i>Sp</i> <i>'19</i>	<i>Sum</i> <i>'19</i>	<i>F</i> <i>'20</i>	<i>Sp</i> <i>'20</i>	<i>Sum</i> <i>'20</i>
Identify Cohorts	*														
Recruiting	*														
Math Anxiety Measures		*			*			*		*					
Attitudes about Science		*			*			*							
Interview Women STEM and non-STEM Students				*						*					
Interview Native Students (STEM and non-STEM)				*						*					
Interview Low Attendees (STEM)	*	*													
Implement PLTL Study Groups		*		*	*		*	*		*					
Measure Success		*		*	*		*	*		*					

Work Step	Semester														
	Early Attrition Points				Tracking and Repeated Measures Testing								Data Analysis		
of PLTL															
Measure STEM Sense of Belonging/Self-Identity		*			*			*			*				
Survey of Research Experiences (SURE)			*			*			*						
Interviews of Internship Experience			*			*			*						
Risk of Leaving Scale and Predictors											*	*	*	*	
Changes in STEM Sense of Belonging/Self-Identity											*	*	*	*	
Final Report/Publications													*	*	*

\*=data collection points

**Overall Project Evaluation:** [REDACTED], who has extensive experience in evaluating NSF projects, will conduct an independent evaluation of the BEST project's effectiveness. The evaluation plan has been developed specifically to ensure the greatest possible outcomes. The degree to which the project has undertaken and completed its major research activities will be evaluated, including: 1) recruiting students; 2) implementing academic and student support services; 3) administering data collection instruments; and 4) analyzing data. All data collected through the research element of this project will be analyzed by the Co-PI research team. [REDACTED]. [REDACTED] is responsible for collecting and analyzing data related to the evaluation questions listed in Table 7. [REDACTED] will provide formative information to ensure continuous improvement of support services to ensure they foster retention and degree completion. A summative evaluation will gauge the project's effectiveness in meeting its goals and inform long range planning.

Table 7. Evaluation Questions, Data Analysis and Timeframe

Evaluation Questions	Sources of Data	Data collection plan/timing
<b>Question 1:</b> How effective is the program in recruiting Biology or Environmental science students into the program and establishing cohorts?		
1.1. What is the process of recruiting students and how successful is the process?	1.1. Interview program leadership	1.1. Years 1-5, 2x/yr., qualitative narrative analysis

<b>Evaluation Questions</b>	<b>Sources of Data</b>	<b>Data collection plan/timing</b>
<b>1.2.</b> In what ways are the students in the cohort collaborating together and how is being in a cohort facilitating the learning experience?	<b>1.3.</b> Interview program leadership	<b>1.3.</b> Years 1-5, 2x/yr., qualitative narrative analysis.
<b>Question 2:</b> How effective is the program in meeting its yearly activities to conduct social science research related to student retention and academic persistence?		
<b>2.1.</b> Is the project on target regarding its research activities (administration of surveys, analysis, etc.) and what challenges, if any, have been faced in implementing the research?	<b>2.1.</b> Interview program leadership	<b>2.1.</b> Years 1-5, 2x/yr. Qualitative narrative analysis
<b>2.2.</b> How effective is the longitudinal database for tracking key data to address research questions?	<b>2.2.</b> Interview program leadership	<b>2.2.</b> Years 1-5, 2x/yr. Qualitative narrative analysis
<b>Question 3:</b> How is the BEST project building on existing academic and student supports and program elements?		
<b>3.1.</b> How are resources from existing grants being leveraged to further program goals / objectives?	<b>3.1.</b> Interview program leadership	<b>3.1.</b> Years 1-5, 1x/yr. Qualitative narrative analysis
<b>3.2.</b> What major lessons are being learned? What challenges have been successfully addressed?	<b>3.2.</b> Interview program leadership	<b>3.2.</b> Years 1-5, 1x/yr. Qualitative narrative analysis
<b>Question 4.</b> How is the program aiding and assisting in building and disseminating scientific knowledge about Native and Hispanic students' college recruitment, persistence, retention and success?		
<b>4.1.</b> How are existing grants leveraging their resources to build and disseminate knowledge related to project?	<b>4.1.</b> Interview and/or survey	<b>4.1.</b> Years 1-5, 1x/yr. Qualitative narrative analysis, non-parametric analysis of survey results
<b>4.2.</b> How is the Steering Committee & sub-committees being utilized to disseminate knowledge?	<b>4.2.</b> Interview and/or survey	<b>4.2.</b> Years 1-5, 1x/yr. Qualitative narrative analysis, non-parametric analysis of survey results

## **J. Dissemination**

The BEST program serves as a petri dish for shared learning among faculty, students and external research/industry mentors. A multi-layered plan for dissemination is planned:

- *Dissemination of research project results by students:* Students will have myriad opportunities to present their work at Northern's annual Science Symposium, at local and regional conferences, and at national meetings for those projects with strong and/or publishable results. Students can provide an oral seminar, a science poster or an abstract. In addition, students may have opportunities to publish their work in peer-reviewed journals and other non-peer-reviewed sources.
- *Dissemination of research project results by PI's and Co-PI:* BEST Program longitudinal study results and the practices and programs that support student success will be presented at the American Sociological Association or the National Social Science Association Annual Meetings in Year 5. Results will also be presented at local and regional meetings, and national meetings, including the Best Practices Conference of the Alliance for Hispanic Serving Institute Educators, Society for Advancement of Chicano and Native American Students, and/or the Hispanic Association of Colleges and Universities in Year 5. Positive results will be published in peer-reviewed and other non-peer-reviewed sources.
- *Dissemination on Northern's Website:* A BEST program page on Northern's website will be developed to promote student interactions; post data and provide analyses; share success stories and published papers, articles, abstracts, posters and lessons learned.
- *Northern Foundation Dinner:* Student presentations will inform donors about BEST program successes and individual research project results, which may inspire additional donations that support student scholarships.

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# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>Northern New Mexico College</b> PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR [REDACTED]				<b>FOR NSF USE ONLY</b>	
				PROPOSAL NO.	DURATION (months)
				Proposed	Granted
AWARD NO.					
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)		NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
		CAL	ACAD	SUMR	
1. [REDACTED]		0.00	0.00	2.00	[REDACTED]
2. [REDACTED]		0.00	0.00	2.00	[REDACTED]
3.					
4.					
5.					
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)		0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)		0.00	0.00	4.00	22,600
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. ( 0 ) POST DOCTORAL SCHOLARS		0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)		0.00	0.00	0.00	0
3. ( 0 ) GRADUATE STUDENTS					0
4. ( 21 ) UNDERGRADUATE STUDENTS					22,200
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)					0
6. ( 0 ) OTHER					0
TOTAL SALARIES AND WAGES (A + B)					44,800
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					9,230
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					54,030
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)					
TOTAL EQUIPMENT					0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)					3,000
2. INTERNATIONAL					0
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS \$ 2,250					
2. TRAVEL 2,500					
3. SUBSISTENCE 0					
4. OTHER 102,000					
TOTAL NUMBER OF PARTICIPANTS ( 20 ) TOTAL PARTICIPANT COSTS					106,750
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES					1,600
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION					0
3. CONSULTANT SERVICES					5,000
4. COMPUTER SERVICES					0
5. SUBAWARDS					0
6. OTHER					0
TOTAL OTHER DIRECT COSTS					6,600
H. TOTAL DIRECT COSTS (A THROUGH G)					170,380
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base: )					
TOTAL INDIRECT COSTS (F&A)					0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					170,380
K. SMALL BUSINESS FEE					0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					170,380
M. COST SHARING PROPOSED LEVEL \$ 0		AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME [REDACTED]		<b>FOR NSF USE ONLY</b>			
ORG. REP. NAME* [REDACTED]		INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG	

1 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET



# SUMMARY PROPOSAL BUDGET

YEAR 2

ORGANIZATION <b>Northern New Mexico College</b>				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR [REDACTED]				PROPOSAL NO.	DURATION (months)	
				AWARD NO.	Proposed	Granted
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
	CAL	ACAD	SUMR		Funds granted by NSF (if different)	
1. [REDACTED]	0.00	0.00	2.00	[REDACTED]		
2. [REDACTED]	0.00	0.00	2.00	[REDACTED]		
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0		
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	4.00	22,600		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	0		
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0		
3. ( 0 ) GRADUATE STUDENTS				0		
4. ( 21 ) UNDERGRADUATE STUDENTS				31,400		
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0		
6. ( 0 ) OTHER				0		
TOTAL SALARIES AND WAGES (A + B)				54,000		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				10,058		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				64,058		
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
TOTAL EQUIPMENT				0		
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)				3,000		
2. INTERNATIONAL				0		
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$	4,500					
2. TRAVEL	7,290					
3. SUBSISTENCE	0					
4. OTHER	204,000					
TOTAL NUMBER OF PARTICIPANTS ( 20 ) TOTAL PARTICIPANT COSTS				215,790		
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES				3,000		
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0		
3. CONSULTANT SERVICES				5,000		
4. COMPUTER SERVICES				0		
5. SUBAWARDS				0		
6. OTHER				0		
TOTAL OTHER DIRECT COSTS				8,000		
H. TOTAL DIRECT COSTS (A THROUGH G)				290,848		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base: )						
TOTAL INDIRECT COSTS (F&A)				0		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				290,848		
K. SMALL BUSINESS FEE				0		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				290,848		
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME [REDACTED]				FOR NSF USE ONLY		
ORG. REP. NAME* [REDACTED]				INDIRECT COST RATE VERIFICATION		
				Date Checked	Date Of Rate Sheet	Initials - ORG

2 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION				FOR NSF USE ONLY			
Northern New Mexico College				PROPOSAL NO.		DURATION (months)	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.		Proposed	Granted
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. [REDACTED]				0.00	0.00	2.00	[REDACTED]
2. [REDACTED]				0.00	0.00	2.00	[REDACTED]
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	4.00	22,600
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. ( 0 ) GRADUATE STUDENTS							0
4. ( 16 ) UNDERGRADUATE STUDENTS							26,400
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							49,000
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							9,608
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							58,608
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							3,000
2. INTERNATIONAL							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 4,500							
2. TRAVEL 7,290							
3. SUBSISTENCE 0							
4. OTHER 154,000							
TOTAL NUMBER OF PARTICIPANTS ( 15 ) TOTAL PARTICIPANT COSTS							165,790
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							3,200
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							5,000
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							8,200
H. TOTAL DIRECT COSTS (A THROUGH G)							235,598
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base: )							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							235,598
K. SMALL BUSINESS FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							235,598
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME				FOR NSF USE ONLY			
[REDACTED]				INDIRECT COST RATE VERIFICATION			
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG	
[REDACTED]							

# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>Northern New Mexico College</b>				<b>FOR NSF USE ONLY</b>	
				PROPOSAL NO.	DURATION (months)
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR [REDACTED]				AWARD NO.	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)		NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
		CAL	ACAD		
1. [REDACTED]		0.00	0.00	2.00	[REDACTED]
2. [REDACTED]		0.00	0.00	2.00	[REDACTED]
3.					
4.					
5.					
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)		0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)		0.00	0.00	4.00	22,600
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. ( 0 ) POST DOCTORAL SCHOLARS		0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)		0.00	0.00	0.00	0
3. ( 0 ) GRADUATE STUDENTS					0
4. ( 16 ) UNDERGRADUATE STUDENTS					25,600
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)					0
6. ( 0 ) OTHER					0
TOTAL SALARIES AND WAGES (A + B)					48,200
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					9,536
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					57,736
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)					
TOTAL EQUIPMENT					0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)					3,000
2. INTERNATIONAL					0
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS \$ 4,500					
2. TRAVEL 4,790					
3. SUBSISTENCE 0					
4. OTHER 154,000					
TOTAL NUMBER OF PARTICIPANTS ( 15 ) TOTAL PARTICIPANT COSTS					163,290
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES					3,200
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION					0
3. CONSULTANT SERVICES					5,000
4. COMPUTER SERVICES					0
5. SUBAWARDS					0
6. OTHER					0
TOTAL OTHER DIRECT COSTS					8,200
H. TOTAL DIRECT COSTS (A THROUGH G)					232,226
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base: )					
TOTAL INDIRECT COSTS (F&A)					0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					232,226
K. SMALL BUSINESS FEE					0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					232,226
M. COST SHARING PROPOSED LEVEL \$ 0		AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME [REDACTED]		<b>FOR NSF USE ONLY</b>			
ORG. REP. NAME*		INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG	

4 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION <b>Northern New Mexico College</b>				<b>FOR NSF USE ONLY</b>	
				PROPOSAL NO.	DURATION (months)
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR [REDACTED]				AWARD NO.	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)		NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
		CAL	ACAD		
1.		0.00	0.00	0.00	
2.					
3.					
4.					
5.					
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)		0.00	0.00	0.00	0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)		0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. ( 0 ) POST DOCTORAL SCHOLARS		0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)		0.00	0.00	0.00	0
3. ( 0 ) GRADUATE STUDENTS					0
4. ( 3 ) UNDERGRADUATE STUDENTS					4,800
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)					0
6. ( 0 ) OTHER					0
TOTAL SALARIES AND WAGES (A + B)					4,800
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					432
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					5,232
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)					
TOTAL EQUIPMENT					0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)					3,000
2. INTERNATIONAL					0
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS \$ 1,600					
2. TRAVEL 2,500					
3. SUBSISTENCE 0					
4. OTHER 52,000					
TOTAL NUMBER OF PARTICIPANTS ( 10 ) TOTAL PARTICIPANT COSTS					56,100
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES					1,600
2. PUBLICATION COSTS/DOCUMENTATION/DISEMINATION					0
3. CONSULTANT SERVICES					5,000
4. COMPUTER SERVICES					0
5. SUBAWARDS					0
6. OTHER					0
TOTAL OTHER DIRECT COSTS					6,600
H. TOTAL DIRECT COSTS (A THROUGH G)					70,932
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base: )					
TOTAL INDIRECT COSTS (F&A)					0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					70,932
K. SMALL BUSINESS FEE					0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					70,932
M. COST SHARING PROPOSED LEVEL \$ 0		AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME [REDACTED]		<b>FOR NSF USE ONLY</b>			
ORG. REP. NAME* [REDACTED]		INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG	

5 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>Northern New Mexico College</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR [REDACTED]				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. [REDACTED]				0.00	0.00	8.00	[REDACTED]
2. [REDACTED]				0.00	0.00	8.00	[REDACTED]
3.							
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 2 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	16.00	90,400
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. ( 0 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. ( 0 ) GRADUATE STUDENTS							0
4. ( 77 ) UNDERGRADUATE STUDENTS							110,400
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							200,800
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							38,864
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							239,664
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							15,000
2. INTERNATIONAL							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 17,350							
2. TRAVEL 24,370							
3. SUBSISTENCE 0							
4. OTHER 666,000							
TOTAL NUMBER OF PARTICIPANTS ( 80 ) TOTAL PARTICIPANT COSTS							707,720
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							12,600
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							25,000
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							37,600
H. TOTAL DIRECT COSTS (A THROUGH G)							999,984
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							999,984
K. SMALL BUSINESS FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							999,984
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME [REDACTED]				FOR NSF USE ONLY			
ORG. REP. NAME* [REDACTED]				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## Budget Justification

### (A) Senior Personnel Costs: Compensation for the Principal Investigator and one Co-PI:

- This budget includes a 2.0-month summer salary of [REDACTED] per year in Years 1 - 4 for the PI, [REDACTED], who will be responsible for project management, reporting and overall monitoring of the project; working closely with the two Co-PI's, faculty mentors and research mentors; and Chairing the Steering Committee. This level of administrative commitment requires 2.0 summer months. [REDACTED] is on a 10-month contract with Northern at a base salary of [REDACTED] per year.
- This budget includes a 2.0-month summer salary of [REDACTED] per year in Years 1 - 4 for the Co-PI, [REDACTED] for conducting and overseeing the social science research; and data collection and analysis of the longitudinal study. [REDACTED] is on a 10-month contract with Northern at a base salary of [REDACTED] per year.
- This budget does not include any salary for Co-PI, [REDACTED] as he is on a 12-month contract with Northern and is not able to receive additional compensation for his role in this grant project. However, he will contribute a one-month academic year time commitment to overseeing the student support services, communicating the project more broadly, and training the Peer Mentors.

Annual Total Senior Personnel Costs: \$22,600. Five-Year Project Total: \$90,400.

### (B) Other Personnel Costs – Undergraduate Students:

- Social Science majors supporting [REDACTED] in the data collection for the longitudinal study: 4 Students @ 5 hours/week x \$10/hr. Total number of weeks varies over four years:

Year 1: 14 weeks = \$2,800; Year 2 and 3: 28 weeks = \$5,600; Year 4: 24 weeks = \$4,800.

**Five-Year Project Total: \$18,800.**

- Peer-led Team Learning Mentors: 2 Upper Division Biology and Environmental Science majors and 2 Upper Division Psychology majors will lead two study groups for the scholarship recipients in Year 1 through 4. In Year 5, only three Peer Mentors will be required for the remaining 10 scholarship recipients (one Biology, one Environmental Science and one Psychology major). They will form one study group. They will work 10 hours/week x \$10/hr. Total number of weeks varies over five years:

Year 1: 16 weeks = \$6,400; Year 2 through 4: 32 weeks = \$12,800/year; Year 5: 16 weeks but only three Peer Mentors for 16 weeks = \$4,800

**Five-Year Project Total: \$49,600.**

- Summer Industry Internship Stipends for scholarship recipients to engage in a summer regional workforce internship with noted Collaborators. Each student will receive \$1,000

for 100 hours of work. The total number of internship positions varies in Years 1 through 4, with no summer internships in Year 5:

Year 1 and 2: 13 students = \$13,000/year; Year 2: 13 students = \$13,000; Year 3 and 4: 8 students = \$8,000/yr. **Five-Year Project Total: \$42,000.**

Annual Total Other Personnel Costs: Year 1: \$22,200; Year 2: \$31,400; Year 3: \$26,400; Year 4: \$25,600; Year 5: \$4,800. **Five-Year Project Total: \$110,400.**

### **(C) Fringe Benefits:**

- A 32% salary benefit rate is included for the PI and Co-PI salaries:

Annual Fringe Benefits on Senior Personnel Salaries: \$7,232. **Five-Year Total: \$28,928.**

- A 9% salary benefit rate is included for student stipends:

Annual Fringe Benefits on Student Stipends: Year 1: \$1,728; Year 2 and 3: \$2,646; Year 4: \$2,484; and Year 5: \$432. **Five-Year Total: \$9,936.**

**Total Five-Year Fringe Benefits Costs: \$38,864.**

**(E) Travel:** For the PI and Co-PI to travel to DC Meetings in Year 1 – 4; and to disseminate results in Year 5 at the American Sociological Association or the National Social Science Association Annual Meetings; and the Best Practices Conference of the Alliance for Hispanic Serving Institute Educators, Society for Advancement of Chicano and Native American Students, or the Hispanic Association of Colleges and Universities. \$1500 per PI per trip.

Annual Total Travel Costs: \$3,000 per year. **Five-Year Travel Total: \$15,000.**

### **(F) Participant Support Costs**

#### **Travel**

- Scholarship Recipient Travel to **local meetings/conferences:**

Year 1: 5 students/year @ \$500 each (\$2,500); Year 2: 10 students @ \$500 each (\$5,000); Year 3: 10 students @ \$500 each (\$5,000); Year 4: 5 students @ \$500 each (\$2,500); Year 5: 5 students @ \$500 each (\$2,500).

***Five-Year Project Total Student Local/Regional Travel: \$17,500.***

- Scholarship Recipient Travel to **national conferences:**

Year 2 through 4: 2 Students/year travel to DC STEM Meeting to report on their research: \$500 flight + \$450 for 2 nights hotel + (\$50 x 3 days) meals + 45 ground transportation = \$1145 per student x 2 students = \$2,290 per year.

**Five-Year Project Total Student National Travel: \$6,870.**

**Five-Year Project Total Student Travel: \$24,370.**

### **Other - Scholarships**

All students will receive \$5,000 scholarships per semester. In Year 1 and 5, there is only one semester. In Years 2 through 4, there are two semesters per year.

Year 1: 10 Freshman @ \$5,000 each; 5 Sophomores @ \$5,000 each; 5 Juniors @ \$5,000 each = \$100,000 Total.

Year 2: 10 Freshman @ \$10,000 each; 5 Sophomores @ \$10,000 each; 5 Juniors @ \$10,000 each = \$200,000 Total.

Year 3: 10 Freshman @ \$10,000 each; 5 Sophomores @ \$10,000 each = \$150,000 Total.

Year 4: 10 Freshman @ \$10,000 each; 5 Seniors @ \$10,000 each = \$150,000 Total.

Year 5: 10 Freshman @ \$5,000 each = \$50,000 Total.

**Five-Year Project Total Scholarships: \$650,000.**

### **Other – Childcare Stipends for Parents in Need of Financial Support for Childcare**

In order for the many students with children to participate in the study groups and other extracurricular activities during the academic year, childcare stipends will be provided on an as-needed basis for an estimated 15 hours/week in Year 1 through 4 and 10 hours/week in Year 5, at \$10/hour. In Year 1 there is only one semester (minus the one week for Fall Break) = 15 hours/week x 15 weeks x \$10/hour = \$2,250. Years 2 through 4 = 15 hours/week x 30 weeks x \$10/hour = \$4,500/ year. Year 5, there will only be 10 scholarship recipients remaining; hours will decrease to 10 per week for 16 weeks = \$1,600.

**Five-Year Project Total Childcare Stipends: \$17,350.**

### **Other – Extracurricular Activities**

The budget includes funding for one (1) extracurricular activity per month for 4 months/ semester @ \$500 per event. In Year 1 and 5 there is only one semester. In Years 2 through 4 there are two semesters:

Year 1 and 5: \$2,000/year; Year 2 through 4: \$4,000/year

**Five-Year Extracurricular Activity Total: \$16,000.**



**Total Five-Year Participant Support Costs: \$707,720.**

**(G) Other Direct Costs:**

- **Materials and Dissemination:** Office supplies, paper, printer toner; research poster materials; and program brochures/fliers/posters for the recruitment effort and scholarship application process. \$290 in Year 1 for IBM® SPSS® Statistics Faculty Pack 23.

Year 1 and 5: \$1,600; Year 2: \$3,000; Year 3 and 4: \$3,200. Five-Year Project Total: \$12,600.

- **Consultant Services: External Evaluator** [REDACTED] will conduct an independent evaluation of the BEST project's effectiveness, including formative information to ensure continuous improvement of support services, and summative evaluation to gauge the project's effectiveness in meeting its goals and inform long range planning. [REDACTED] will receive \$65 per hour for 77 hours per year for five years.

Annual Total: \$5,000. Five-Year Project Total: \$25,000.

**Total Five-Year Other Direct Costs: \$37,600.**

**TOTAL DIRECT COSTS: \$999,984.00**

Year 1: \$170,380

Year 2: \$290,848

Year 3: \$235,598

Year 4: \$232,226

Year 5: \$70,932

**(I) Indirect Costs:**

No indirect costs are being charged to this grant.

**TOTAL FIVE-YEAR COSTS: \$999,984.00**

## **Facilities, Equipment and Other Resources**

### **I. Research Equipment and Support Facilities at Northern New Mexico College**

Northern supports two campuses, each equipped with basic research facilities that encourage undergraduate research experiences (URE) in STEM. The Espanola Campus serves as the main campus for the BEST program.

**A. Biology and Chemistry:** Facilities reside in four General Education laboratories. Four of these labs are dedicated to faculty-directed URE initiatives. Throughout the academic year and summer, undergraduate students are involved in experiments and training with basic research in the following laboratories and research settings:

**1. Molecular and Cell Biology Laboratory:** Location: General Education Building, Room 105. This laboratory houses basic instrumentation for use in molecular and cellular biology research. A laboratory technician staffs this facility, and includes the following equipment:

- Table top ultracentrifuge and rotors
- Nanopure water purification system
- Thermo Scientific -80° C freezer, Ultima II series
- Isotemp Laboratory refrigerator, 4° C
- -20° C enzyme and other labile reagent freezer
- PCR isolation hood with UV sanitation capability
- Tissue Culture Incubator, floor based, Precision brand
- Electro cell manipulator, ECM 630
- Perkin Elmer GeneAmp 2400 PCR reaction system
- BioRad DNA cycler PCR reaction system
- Hermle Z-383-K programmable temperature controlled centrifuge from Labnet; rotors
- Eppendorf 5417R centrifuge, programmable, temperature controlled, with rotors
- TissueLyser tissue homogenizer from Qiagen
- BioRad Spectrophotometer, Smart Spec Plus
- Nikon TMS inverted Microscope
- UVP Laboratory Products HL-2000 HybriLinker
- Denvill Scientific Incu-block temperature controller for microtubes
- Incubator shaker, floor based, I2400 New Brunswick Scientific
- Kodak Gel Logic Molecular Imaging System with MI imaging software and computer interface for use with UV/Visible/Fluorescence photo-documentation and annotation
- Various pH meters
- Vacuum pump
- Various analytical and top loading balances
- Various water bath incubators
- Various blotting shakers and orbital rotating platforms
- Various vertical and horizontal electrophoresis tanks and power-supplies

**2. Developmental Biology Laboratory:** Location: General Education Building, Room 104A. This basic Developmental Biology Laboratory is for plant, invertebrate, and zebrafish culture, and microscopic imaging/analysis. Major equipment items in this lab include:

- Aquaneering Fish Breeding rack assembly with filtration system and temperature control
- Dissection microscope, camera mount with external, adjustable light source, dedicated computer and monitor. Mounted on the above-mentioned Vibration Control Unit.
- Intracellular electrometer and AC/DC differential Amplifier with regular head-stage.
- Gimbal Piston Vibration Control Unit, with tabletop and Faraday Cage
- Fluorescence Microscope
- Horizontal Laminar air-flow work station for dry, non hazardous work.
- Microtome Histogrange specimen slicer with and paraffin slide preparation station
- TissueTek sample processing compound console, thermal dispensing and cryo-consoles.
- Aquaneering Fish Breeding assembly including filtration system and temperature control
- Sutter Instrument Co. P-30 micropipette puller

**3. GE Chemistry & Biochemistry Facility:** Location: General Education Building, Room 205. The laboratory serves as both a teaching and research-ready laboratory with the following equipment items:

- Perkin Elmer FTIR Spectrometer, Spectrum 100 – with computer, monitor and printer
- Büchi assembly, C-620 control unit, C-660 fraction collector, C-640 UV photometer
- Perkin Elmer Clarus 500 gas chromatograph with computer, monitor and printer
- Hewlett-Packard HP 8452A diode array spectrophotometer
- Standard chemistry safety hoods and associated equipment

**4. Microbiology/Tissue Culture Facility:** Location: General Education Building, Room 206. This BSL-2 tissue culture facility includes:

- Class II type AZ laminar flow biological safety cabinet, from ESCO
- VWR Symphony incubator, with CO<sub>2</sub> monitor and alarm
- Four Olympus CX41 light microscopes
- Workbenches and support area

**5. Office Space and Support Laboratories:** Location: General Education Building (Various). The College of Arts and Sciences provides office space and administrative support for faculty. Office equipment in each area includes:

- Internet linked Desktop PCs; Color Laserjet CP3505x printers and scanners
- Various InFocus projectors
- GE 204 and GE 204A provide support space for general biology, microbiology and plant biology resources and for general chemical inventory.

**B. Environmental Science:** Facilities reside in the General Education and High Technology Building laboratories. All of these labs are dedicated to faculty-directed URE initiatives. Throughout the academic year and summer, undergraduates are involved in experiments and training with basic research in the following laboratories and research settings:

**1. Environmental Monitoring and Natural Resource Management Facilities:** Location: General Education Building, Rooms 102, 104, 204, and 205; High Technology Building, Room 119 and 125. A GIS computer lab in HT 119 services courses and research for GPS, GIS, and Cartography for Environmental Science and Engineering students. The other laboratory serves as both a teaching and research-ready laboratory, sharing many of the same resources with the Chemistry department for analysis of soils and water with the following equipment items:

- Perkin Elmer FTIR Spectrometer, Spectrum 100 – with computer, monitor and printer
- Büchi assembly, C-620 control unit, C-660 fraction collector, C-640 UV photometer
- Perkin Elmer Clarus 500 gas chromatograph with computer, monitor and printer
- Hewlett-Packard HP 8452A diode array spectrophotometer
- Standard chemistry safety hoods and associated equipment
- YSI Pro Plus Multiparameter water meter
- Hach DR2000 water spectrophotometers
- ArcGIS software-ready desktops (15+ computers)
- LaMotte Soil pH and conductivity meters
- 5x Olympus SZ61 dissecting microscopes
- Olympus LG-PS2 light source
- Lumenera infinity HD camera
- Olympus BX53 microscope (DAPI, YFP, GFP and RFP filters)
- QIClick cooled CCD camera
- Olympus U-RFL-T fluorescent light source

**C. Mathematics and Science:** Facilities reside in the High Technology Building laboratories. Two of these labs are dedicated to faculty-directed undergraduate research experience initiatives. Throughout the academic year and summer months, undergraduates are involved in experiments and training in basic research in the following laboratories and research settings:

**1. Aguila Parallel Supercomputer**

Northern's Aguila supercomputer has 18 processor, 108-core Linux based computer cluster funded by the Army High Performance Computing Research Center (AHPCRC). Aguila is connected to the campus enterprise via 1 Gbps connection to the core/distribution (although end devices are connected via Fast Ethernet ports). Faculty and students have access to Aguila through laboratory rooms. An Aguila node (composed of 12 cores) is connected to the rest of the nodes through Infiniband. Aguila has the following tools installed:

- C, Fortran, Gaussian 09, and MPI compilers
- Matlab software
- Linear Algebra Packages such as BLAS and LAPACK
- Aguila is currently accessible via the campus enterprise network

**2. High Tech 101:** Location: High Technology Building, Room 101. This computer lab contains the following equipment:

- 20 PC Computers with MATLAB software installed
- Workstation dedicated to accessing the Parallel Supercomputer

**3. ADM Conference Room:** Located in the Administration Building, the following equipment is available to the Mathematics and Science Department:

- Computer on Wheels (COW) with 25 laptops, each with the Microsoft suite software.

## **II. Educational Environment on the Espanola Campus**

The Northern New Mexico College Espanola Campus is a comprehensive campus with state-of-the-art computer and laboratory facilities for classroom instruction, a fully-equipped Student Support Services Center, which includes a computer lab, tutorial assistance, study groups, peer mentors, and testing services. A newly-built library contains spacious and light-filled private and open rooms. With comfortable furniture and internet-ready computers, the library is a magnet for students to gather and study, for faculty to meet in one of several conference rooms, and for a variety of campus-wide activities, including Phone-a-thons, Research Symposia, and other educational exhibits. Northern also has an open and spacious student union, bookstore, and is renovating its Advising wing.

Moreover, Northern has a new Fine Arts building and a very adequate Recreation Center with basketball courts, a weight and cardio room, racquetball and volleyball courts and a sauna. Much effort is placed in providing students with recreational and communal opportunities to engage in campus life. Myriad student organizations and support groups, as well as programs in Dance, Fiber Arts, Film, Flamenco, Music, and Theatre are provided through traditional and non-traditional programs.

The college also hosts an American Indian Center, which now includes the American Indian Affairs Office, Northern Pueblos Institute and Pueblo Indian Studies. A Small Business Development Center provides small business assistance with business planning, marketing, business financing, small business start up, entrepreneur training, and other specialized areas to help grow and strengthen businesses in New Mexico. The NMSBDC is a partnership of the U.S. Small Business Administration, the State of New Mexico, the New Mexico Association of Community Colleges, and the private sector.

Many students arrive at Northern with math and writing deficiencies and require extensive remediation and support. Through Title V grant funding, the College also hosts a:

- Math Tutoring Center – Housed in the new and state-of-the-art High Tech building, the Math Center provides computers loaded with necessary software and tutoring for all levels of math to all students, free of charge.

- Writing Center – Housed in the main General Education Building, The Writing Center provides computers, printers and comprehensive tutoring and writing support to all students, free of charge.
- On-site Counseling Services are available to students who wish to speak to a professional counselor about personal, work and school related issues, free of charge.

In addition to these and other specific departmental resources (such as the Engineering Tutoring Center), Northern also supports a college-wide Accessibility Resource Center, the Educational Opportunity Center and a Veterans Resource Center.

Northern's fundamental mission is to provide accessible, affordable, community-based, quality learning opportunities for the educational, economic, and societal needs of the state. This mission is achieved by providing a high quality undergraduate education that emphasizes comprehensive and relevant knowledge and transferable skills in preparation for professional careers. Northern is recognized as both a Hispanic and Native American Serving Institution as defined by Title V of the U.S. Department of Education.

Finally, a state chapter of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS), one of only two in the state of New Mexico, has been established at Northern under the leadership of Dr. Ulises Ricoy. This and myriad other student organizations in every department exist to strengthen community among students and to provide leadership and other important training. In recent years, Northern's efforts toward strengthening its STEM programs has been supported with funding from the National Science Foundation, the Department of Education's Title III and Title V, CCRAA funding, and from the Los Alamos National Security (LANS) Community Outreach investment fund, NM-INBRE, PNM and the Grass Foundation, among others.

### **III. Other Resources**

#### **Summer Undergraduate Research Experience Collaborators:**

Northern STEM faculty serve as Co-PI's and Collaborators on grants awarded to faculty at large research-based colleges and universities throughout the U.S. that provide support for intensive summer research experiences. These grant-based programs will provide Northern's S-STEM scholarship recipients with a variety of options for summer research-intensive experiences. These collaborations include:

- University of Texas at El Paso (UTEP) - Northern serves as one of four pipeline partners in UTEP's NIH funded BUILDing SCHOLARS Center. This program provides a yearly 10-week, fully paid summer research program for 15 pipeline partner students. Thus 3-5 qualified S-STEM scholars from Northern would be fully supported assuming student interests align with faculty projects offered. UTEP also hosts several other summer programs in biosciences, computer science and neuroscience in which S-STEM scholars will also be highly encouraged to participate.
- University of Massachusetts-Amherst (UMass) - Dr. Ricoy serves as a Co-PI on an REU proposal submitted in August 2015 with Dr. Gregory Tew (PI) to create an NSF REU Summer Site at UMass in the Polymer Science and Engineering Department. If funded,

Dr. Ricoy will play an essential role in the recruitment efforts of interested students from Northern. The REU program aims to host 8 undergraduates each summer to engage in projects in the areas of supramolecular polymer science, directed self-assembly, bioinspired and biomimetic structures, self-organization, well-defined macromolecular architectures, metal-containing polymers, membrane biophysics, physical organic chemistry, sensors, hydrogels, anion exchange membranes, alkaline fuel cells.

- New Mexico State University - Dr. Pedro Chavarria, faculty in the Environmental Science program and a collaborator in this proposal, is a Co-PI on a USDA NIFA grant with Martha Desmonds (PI), Professor of Fish, Wildlife and Conservation Ecology at New Mexico State University, which sponsors several summer research programs in which environmental science S-STEM scholars will be highly encouraged to participate.
- Dr. Stephen Meriney - University of Pittsburgh Professor of Neuroscience and Psychiatry: Regulation and modulation of presynaptic ion channels and transmitter release in healthy and diseased synapses.
- Dr. William Atchison - Michigan State University Professor of Pharmacology and Toxicology: Understanding the basis of cellular neurotoxicity especially at synapses.
- Dr. Edward Castañeda – UTEP Professor in the Department of Psychology: Plasticity in presynaptic mechanisms that modulate neurotransmitter release during changes in behavior due to neurodegeneration or substance abuse.

#### **Workforce Development Collaborators:**

Northern is also collaborating with members of local industry to provide S-STEM scholarship recipients with summer internships that will foster their professional and career development, and present them with choices and options in their future careers. Collaborators from the workforce sector include:

- Los Alamos National Laboratory, Bioscience Division
- Los Alamos National Laboratory, National Security Education Center - Student Programs
- Los Alamos National Laboratory, Center for Integrated Nanotechnologies, Materials, Applications and Physics
- Biohabitats, Southwest Basin and Range Bioregion – A conservation planning, ecological restoration and regenerative design firm with regional offices in Santa Fe, NM and Denver, CO
- National Center for Genome Resources - A 501c(3) nonprofit research institute that applies bioinformatics, software engineering and next-generation sequencing to solve the biological challenges; provides researchers with experimental design assistance, custom data analysis, and data visualization; and is dedicated to ensuring the health and food security of future generations.

#### **Co-PI and STEM Faculty Research Mentors Not Included in the Budget**


- Co-PI, Tobe Bott-Lyons, Director of Academic Advising and First Year Experience: Mr. Bott-Lyons is a specialist representing student services and will effectively communicate the program, its goals, objectives and outcomes across the varied departments within the institution. He will also encourage and continue to implement innovative student support programs that foster cohort development, student success, retention, and degree

completion. He will also train the Peer-led Team Learning mentors and will work with them throughout the semester to provide additional support, training, and leadership to ensure that student mentors are effective.

- A group of Northern STEM faculty has agreed to serve as Research Mentors and will provide undergraduate research experiences to those S-STEM scholarship recipients who chose to engage in research beyond the required research coursework that all biology and environmental science majors must complete. During the academic year, scholarship recipients can choose from the following faculty and research areas:

STEM Faculty	Academic Program	Area of Research Interest
[REDACTED]	Biology; Neuroscience	Neurobiology: Interactive training in the use of invertebrates to study synaptic physiology and anatomy. Analyzing data recorded from neural activity in invertebrate models. Behavioral modulation under various environmental and use-dependent conditions.
[REDACTED] [REDACTED]	Cell Biology	Plant Genomics: The role of nuclear organelles in the synthesis and processing of RNA. Nuclear bodies and the control of transposable elements in frog oocytes and <i>Drosophila</i> .
[REDACTED]	Neuroecology	Examination of the genomes and epigenomes of lizard populations to ultimately associate phenotypic responses (morphological and behavioral) to invasive species with underlying genetic variation and expression.
[REDACTED]	Chemistry	Water Quality: Studies include monitoring levels of alkalinity, metals, and organic pollutants present in water, monitoring temporal and spatial change in water quality and bioaccumulation of pollutants in crops.
[REDACTED] [REDACTED]	Environmental Science	Landscape Ecology Modeling, Simulation and GIS: Environmental process impact on community ecology and how stochastic events drive these processes in response to climate change. Assess the distribution of macro-invertebrates in response to droughts and flood regimes.
[REDACTED]	Mathematics	Computational Fluid Dynamics and Parallel Programming: Computational Biology in Honey Bee Populations and Synaptic Diffusion.



STEM Faculty	Academic Program	Area of Research Interest
	Mathematics	Numerical Modeling: Designing predictive models for seasonal pollen release in the atmosphere in New Mexico. Analysis of Irradiance data and correlation with local weather in Albuquerque, NM. Various applications of Computational Fluid Dynamics. Heat Transfer: The science of food cooking.

#### IV. Research Oversight, Compliance and Safety

Northern maintains a commitment to the highest standards of integrity in all aspects of its educational mission. This includes adherence to standards of ethics in all areas of teaching, research and mentoring activities undertaken by its faculty, staff and students. Northern maintains compliance with federal, state, and institutional regulations and policies. The Office of Institutional Advancement, administration, and faculty leaders provide oversight over the responsible conduct of research and ensure conformity with regulatory requirements relating to research, including humane treatment of human and animal subjects and safety in the use of recombinant DNA and hazardous agents. Towards this end Northern maintains an Institutional Review Board (IRB) with that reviews all proposals that require any aspect of human surveys or sampling. All units within the College interface with the institution's safety and security committee to assure adherence to OSHA and other safety processes, protocols and practices, including providing requisite training and related educational programs for all employees.

## **Data Management Plan**

**Types of data collected:** Data to be collected for the BEST Program includes:

- Student participant academic and FASFA data
- Student participant identifying information for tracking
- Student participant surveys; compilation of face to face interviews and success stories
- Samples of student's research projects (science posters, video/recordings of lectures, copies of abstracts and journal articles)
- Student participant retention, graduation and post-secondary/career data

**Data Standards:** Text data will be saved as MS Word files and pdf documents; tabular data will be saved as Excel spreadsheets or data tables; and photos will be saved as .jpg files. Raw data will be entered into SPSS as data files and aggregate data will be included in reports. Statistical analyses will be performed to include: correlations, regression equations, alpha coefficients, and T-tests, as appropriate.

**Policies for Access and Data Sharing:** Student participant and applicant data will be shared among the BEST Steering Committee members during the selection process. Only the PI will maintain electronic copies of application data, and when performing the selection process, printed copies will be distributed and recollected after the selection process is complete. Faculty will have access to emergency contact data for their student participants. Dr. Marquez will have access to raw participant survey data, which will be coded so that participants can be tracked. Confidentiality procedures will be observed. Data will be stored encrypted on a password protected computer. Only aggregate data will be provided to the Steering Committee. All retention, graduation and career data, as well as participant demographics, academic progress, etc., will be stored encrypted on a password protected computer belonging to the PI. Samples of student research, photos and stories collected will be posted on Northern's website, with written permission from the participants. The PI will be responsive to requests for data from researchers and the public. IRB protocols will be followed with respect to data collection, accessibility, confidentiality, informed consent procedures, and anonymity of human subjects. Psychology students conducting the research will all obtain NIH Human Subjects Rights ethics certificates.

**Policies for Re-Use, Redistribution:** Northern will apply for and employ a Creative Commons CC BY license to allow for greater sharing of reports and information.

**Plans for Archiving & Preservation:** This Program will not require special long-term storage facilities other than Northern's web-server. Summary data will be available on Northern's website for two years after the project end-date, stored for seven years in the Northern data storage system, and archived in the Northern library archival system thereafter.

**Other policies related to confidential information include the following:**

- No personal student information (including name, email, address, phone or student ID) will become available to the public, except in cases where materials are published and informed consent has been obtained.
- All informed consent protocols and confidentiality procedures will be observed.
- Personal student information in electronic form will be stored and backed up in encrypted files in local (Espanola Campus), secure hard drives with no access to the public. Paper materials from students will remain stored in the Biology Department Archives.